DOCKET NO.: KCX-435 (16066)

UNITED STATES PATENT APPLICATON

FOR

APPARATUS FOR SEVERING, CARRYING, OR WINDING A WEB

BY

Steven J. Wojcik

John Hanson

Scott Bosley

Shane Emmons

Jeff Greiner

Fred Marvel

John Mikulan

And

Walter Montgomery

DOCKET NO.: KCX-435 (16066)

Title of the Invention

Apparatus For Severing, Carrying Or Winding A Web

Background of the Invention

Rewinders convert large industrial parent rolls into retail-sized rolls of bathroom tissue, paper towels and the like. Center rewinders are described in United States Reissue Patent No. 28,353 (hereafter "the '353 patent"). Center rewinders are adapted to wind a web on a core that is rotated by a turret.

Cut-off and transfer is a critical operation in rewinding rolls. The web must be severed to cease the winding of a roll. Then, the leading edge of the severed web must be transferred to a new core. Then, the new core must be rotated to begin winding of a new roll. These steps must be accomplished repeatedly and reliably while the web is moving at high speed. It is desirable that each roll reveals an exact sheet count so the web is wound uniformly.

In the industry, the term "bedroll" usually refers to the main winding roll of a rewinder. For example, in the '353 patent a bedroll is used with a chopper roll to sever the web after a predetermined length of web has been wound onto a log. The bedroll transfers the leading edge of the severed web to a new core in a continuous winding process. In the apparatus disclosed in the '353 patent, the severing and transfer mechanism includes a series of pins, cut-off blades, and transfer pads, all of which are mounted within the bedroll. When the severing and

transfer mechanism is unlatched, the pins hold the web against the rotating bedroll while the web is severed by interaction of the chopper roll with blades that emerge from the bedroll.

Center winders commercially available in the industry and sold by Paper Converting Machine Company of Green Bay, Wisconsin may include moveable pins in a bedroll for holding the leading edge of the severed web, and for carrying the leading edge into position. Further, a latch mechanism may be used for retaining the pins in an inoperative position until the web is to be severed. A cut-off knife may be fixed in a chopper roll and the cut-off blade in the bedroll may be movably mounted.

Bedroll blade and pin assemblies must be changed periodically for maintenance. In such operations, it is desirable to replace or adjust assemblies without adversely affecting critical setup dimensions and fine tolerances. In conventional designs, the blade assembly includes clamps that must be loosened on the cross-shaft to replace parts. The setup dimensions between bedroll pins, pads and the mandrel must be reestablished each time the parts are changed using conventional apparatus. The top bedroll cover usually must be removed to access such mechanical assemblies. It is common, therefore, for a large amount of machine "down time" to be incurred in changing and re-setting such blades and pins. Furthermore, there exists a risk of error in setting

the clearance between the pins and the mandrel, which can be a time consuming and difficult problem.

U.S. Patent No. 4,280,669 (the " '669 patent") discloses an automatic web rewinder for a tensioned web. In Figure **10** of the '669 patent, a configuration that employs individual pins is shown. Such pins must each be replaced separately, resulting in a relatively long and difficult maintenance procedure that must be periodically performed on such apparatus.

What is needed in the industry is an improved design for a blade and pin assembly that facilitates a change of pins and blades without undesirably affecting critical setup tolerances. Furthermore, an apparatus and method that minimizes the amount of labor involved in changing pins and/or blades would be desirable. An assembly that can reduce the amount of down time incurred in repair operations would be useful.

Summary of the Invention

The invention comprises an apparatus or device and method for severing and carrying a sheet or web in a winding operation. In one embodiment of the invention, a first blade and a second blade are provided, in which the first blade and second blade are connected and spaced apart a predetermined distance to form a gap. The first and second blades are adapted to bear against the surface of a web, further wherein the gap is sized so as to receive another blade or tearing

member between the first blade and second blade in severing a web or sheet.

Furthermore, in one application of the invention, a unitary elongated mandrel is connected to at least the first blade, the mandrel comprising a plurality of spaced pins projecting from the mandrel and spaced along its length, the pins being configured for piercing and carrying a severed web.

The device of the invention typically is mounted within a bedroll which rotates to feed a sheet or web. The sheet may include paper, textiles, synthetics, or other fabrics or webbing. In many instances, the sheet or web fed by the bedroll previously has been perforated, so that tearing or severing requires relatively little force. The device also may include a spacer between the first blade and second blade to set the space of the gap at a predetermined distance that is most effective for severing or tearing the sheet.

In many applications of the invention, a unitary elongated mandrel having a series of pins along its length is configured to project from the exterior surface of the bedroll at a point in time just prior to the web being severed, to hold the web in place against the bedroll once the web has been separated. A pin assembly may be movable from a first position in which pins are held beneath the outer circumference of the bedroll, to a second position in which all or some of the pins project from the outer surface of the bedroll.

The device of the invention also may include pins that are oriented in substantially the same direction. Replacement of the unitary elongated mandrel with its associated pins usually may be accomplished by mounting the unitary elongated mandrel upon the front side of the clamp.

Brief Description of the Drawings

A full and enabling disclosure of this invention, including the best mode shown to one of ordinary skill in the art, is set forth in this specification. The following Figures illustrate the invention:

Figure **1** illustrates a center rewinder as employed in the practice of the invention;

Figure **2** is a transverse sectional view of the bedroll, which is shown in the center of Figure **1**;

Figure **3** is a perspective view of a pin assembly having a unitary mandrel with pins projecting from the mandrel;

Figure **4** shows an exploded view of the pin assembly of Figure **3** in which blades are separated from the mandrel for illustrative purposes;

Figure **5** reveals a cross-sectional side view of a pin of the assembly as taken along lines **5-5** of Figure **3**, further showing the front mounting of the mandrel or pin assembly upon a clamp in a bedroll;

Figure **6** shows a perspective view of pins impaling the web just prior to web separation, wherein web separation occurs by interaction between the chopper roll and the bedroll;

Figure **7** is a perspective view showing the position of the bedroll a moment after that shown in Figure **6** as the web is severed along a perforation by entry of a chopper roll blade in between blades of the bedroll; and

Figure **8** illustrates a view of the carrying and transfer of the leading edge of the upstream portion of the web, a moment after that shown in Figure **7**, wherein the web is moved from the bedroll to a new core **83** on the turret assembly.

Detailed Description of the Invention

Reference now will be made to the embodiments of the invention, one or more examples of which are set forth below. Each example is provided by way of explanation of the invention, not as a limitation of the invention. In fact, it will be apparent to those skilled in the art that various modifications and variations can be made in this invention without departing from the scope or spirit of the invention. For instance, features illustrated or described as part of one embodiment can be used on another embodiment to yield a still further embodiment. Thus, it is intended that the present invention cover such modifications and variations as come within the scope of the appended claims and their equivalents.

Figure **1** shows a portion of a center rewinder **1** that may be employed in the practice of the invention. It should be noted, however, that the invention also may be employed with surface rewinding

equipment, and is not limited to the specific center rewinding apparatus of Figure **1**.

Rewinder **1** includes a frame **16** and a bedroll **17** rotatably mounted in the frame. A turret assembly **18** is rotatably mounted in the frame below the bedroll **17**. The turret assembly **18** further includes a plurality of rotating mandrels such as winding position mandrel **19** where paper is wound upon core **10**. After winding, the turret assembly **18** rotates, moving so that position **9** (log cutting position), position **8** (log stripping position), and position **7** (core loading position) are taken in sequence.

An adhesive applicator apparatus **4** applies transfer adhesive onto new cores **83** at glue applicator position **6** before each winding cycle. Cores are located at each position of the turret assembly (see core **10**, for example, in Figures **6-8**, or core **83** in Figure **1**), and they are rotated at predetermined time intervals to carry on each step of the tissue winding process. At glue pre-spin position **5**, the core which has moved up from glue applicator position **6**, with glue on its outer surface, is pre-spun to bring it up to a high rotational speed. This speed may be as high as 4,000 rpm, or in some cases even as high as 6,000-7,000 rpm, depending upon the particular product produced and process utilized.

Bedroll **17** delivers the web **23** (as further described below in connection with Figures **6-8**) to the glue pre-spin position **5** just at the point at which that turret assembly **18** is placed in rotation towards the

winding position **19**, and the free end of the severed web **23** is carried in a counterclockwise direction for some distance around the bedroll **17**, and attached to a new core **83** (Figure **8**) as further described below. Of course, other embodiments of the invention could employ a bedroll **17** that rotates in a clockwise direction, and the invention is not limited to any particular path of rotation of any roll, either clockwise or counterclockwise.

In Figure **2**, a closer view of the bedroll **17** of Figure **1** is seen in which a pair of transfer pin pivot shafts **30** and **31** are rotatably supported within the bedroll **17**. The transfer pin pivot shafts **30** and **31** extend the length of the bedroll, and are seen in cross-section in Figure **2**. A plurality of transfer pins **35** and **34** are clamped to each of the transfer pin pivot shafts **30** and **31**, respectively. For example, transfer pin **34** is clamped to transfer pin pivot shaft **31** by a clamp **40**. Transfer pad **37** is clamped to transfer pad pivot shaft **33** by way of clamp **41**. On the opposite side of the bedroll, clamp **36** securely holds transfer pad **50**, and is connected to transfer pad pivot shaft **32**. Likewise, transfer pin pivot shaft **30** is securely connected to clamp **39** to hold the transfer pin **35** in position. Of course, the invention is not limited to bedrolls having any particular number of cut-off and transfer assemblies, and less or more assemblies than that shown in Figure **2** could be employed in the invention.

Push rods, **38a**, **38b**, **38c**, and **38d** are provided in operable connection to clamps **36**, **39**, **40**, and **41**, respectively. An outer cylindrical shell **25** of the bedroll **17** is shown in Figure **2**. Counter-clockwise rotation of the bedroll **17** is shown by arrow **51**. It is the push rods **38a-d** which activate respective transfer pin pivot shafts **30-33**, which in turn provide energy and movement to both transfer pads **37** and **50**, and the transfer pins **34-35**.

Figure **3** presents one embodiment of the invention in which pin assembly **60** comprises a plurality of pins **61** in an integrated unit. That is, a first blade **62** and a second blade **63** are secured and separated by a spacer **64** that is provided between first blade **62** and second blade **63**. A unitary elongated mandrel **65** is shown having an integrated plurality of pins or projections extending therefrom, such as pin **61**. The web engaging assembly **70** (see Figure **5**) is movably mounted within the bedroll, and is movable between a first position in which the web engaging assembly is inward of the outer surface of the bedroll **17** and a second position in which the web engaging assembly **70** projects beyond the outer surface of the bedroll **17** in contacting the web **23**.

The embodiment shown in Figure **3** shows **34** total pins, each of which are similar in structure and function to pin **61**. However, the number of pins employed on a particular pin assembly **60** will be dependent upon the width of the web **23** on the bedroll **17**, and the physical characteristics of the web **23**. There must be enough pins **61** to

ensure that the web does not pull through but indeed is carried by the pin assembly **60** when the web engaging assembly **70** (see Figure **5**) moves beyond the outer circumferential surface of the bedroll **17**, as further discussed below in connection with Figures **6-8**. In any event, the pins (such as pin **61**) need not be identical, but should be configured for piercing and carrying the web **23** a distance to mate with a new core **10**, as further described below in Figures **6-8**.

In most instances, the unitary elongated mandrel **65** could carry 5-20 pins, and be in two or three pieces, providing a total pin count of between about 15 and 120. In other circumstances, it might be advantageous to provide less than 15 pins or more than 120 pins in total, but usually about one pin for every 1-5 inches of cross directional width of web **23** is sufficient.

A "unitary" structure of unitary elongated mandrel **65** as defined herein is a structure which does not rely upon mounting and bolting each pin separately to the unitary elongated mandrel **65**. The unitary elongated mandrel **65** may be a molded integrated portion of high impact plastic or metal that carries multiple pins, which makes replacement of pin assembly **60** convenient. By "integrated", it is meant that the pins are not separately mountable on the mandrel, but are joined to the mandrel in a continuous, uninterrupted structure, without the necessity for mounting hardware associated with each individual pin.

Figure **4** shows an exploded view of the pin assembly **60** (previously shown in Figure **3**) in which second blade **63**, spacer **64**, first blade **62** and unitary elongated mandrel **65** are separated. In that view, one can see alignment holes **67** along the length of the pin assembly **60** which are used to receive a alignment pins, such as alignment pin **73a** (shown in Figure **5**).

Figure **5** shows a partial cross-sectional view of a web engaging assembly **70** as taken along lines **5-5** of Figure **3**. An aperture **78** for a transfer pin pivot shaft **30** or **31** is shown near the top of Figure **5**. The clamp **71** of Figure **5** is not shown, however, in Figures **3** or **4**. The web engaging assembly **70** includes a clamp **71** securely connected to the unitary elongated mandrel **65**. The spacer **64** provides a predetermined and appropriate gap **81**. The gap **81** functions to receive a severing mechanism, such as for example a chopper blade **62** (see Figures **6-7**) when the web is severed, as further described below.

Threaded connector **72** facilitates mounting of the web engaging assembly **70** for attachment to the clamp **71** from the front side (indicated by arrow **80** showing mounting direction), rather than from the bottom, which reduces the time and effort required to change out worn components with new components. The front surface **75** of the clamp **71** is shown in Figure **5**. The bottom surface **76** of the clamp is shown as well. Alignment pins **73a-b** are shown near the center of Figure **5**, and

they assist in holding the first blade **62** and the second blade **63** in position with the appropriate gap **81** there-between.

In Figures **6-8**, a step-by-step view of the high speed severing, carrying and transfer of the web **23** is shown. A web material **23**, shown on the upper portion of Figure **6**, is advanced by draw rolls **20** around a perforator **21** (see Figure **1**) to the bedroll **17**. The perforator **21** forms longitudinally spaced transverse lines of perforation (not shown) in the web **23**. Not all applications of the invention will use perforations or perforator **21**, but most paper toweling and toilet tissue applications include perforations in the final product. Clearly, the invention is not limited to only those applications that use perforated webs. In general, the surface speed of the bedroll approximately matches the speed of the web **23**, at the point where the web **23** engages bedroll **17**.

As a next step, as shown in Figure **6**, the pins (such as transfer pins **35**) are activated by movement of transfer pin pivot shaft **32**, and they move from a first position in which the pads **50** are resting in between the pins to a second position in which pads **50** project from the outer circumferential periphery of the bedroll **17**. Then, the transfer pins **35** engage web **23** by piercing the web, as shown in Figure **6**.

The chopper roll **22** (see Figure **7**) deploys a severing mechanism which in some embodiments comprises a chopper blade **82** extending out from the periphery of the chopper roll **22** and projecting at least partly into gap **81** (gap **81** not shown in Figure **7**, but shown in Figure **5**)

between first blade **62** and second blade **63** of the blade assembly **70**. Passage of the chopper blade **82** into the gap tears the web **23** which is stretched across the first blade **62** and second blade **63** on the surface of the bedroll **17**.

Once the web **23** is separated or severed, it forms an upstream portion **84** and a downstream portion **85**, as shown in Figure **8**. In Figure **7**, the moment immediately following the separation of the web **23** is shown. Figure **8** shows a view of the carrying and transfer of the leading edge of the upstream portion **84** of the web **23**, wherein the web **23** is moved from the bedroll **17** to a new core **83** on the turret assembly **18**. Transfer pins **35** carry the web **23** and hold it securely to the outer circumferential surface of the bedroll **17** until it is taken up on core **10** to form a log **24** at winding position **19**.

Typically, the pin assembly **60** of the invention may be installed with a setup dimension of .090 inches (see Figure **3**) between the pins (such as pin **61**), but other gap widths also may be employed. Holes for mounting screws are counter-bored in the spacer **64** at spaced intervals, which may be about 1.5 inches, but can less or more, depending upon the particular configuration desired. A range of 0.5 to 4 inches is reasonable for many applications. It is sometimes feasible to provide slight cross-machine direction adjustments of the clamp **71** so that one standard spacer may be used on several winders.

One winder that may be employed in the practice of the invention is a Paper Converting Machine Corporation (PCMC) "Centrum" or "250 Series" continuous winder. In most cases, both blades included in the pin assembly **60** (shown in Figure **4**) are essentially identical in shape and size, but it is not required that they be identical.

A 0.05 inches offset in the blade edges may be used advantageously with the alignment of pins **61,** but greater or lesser offsets may be employed, ranging from about 0.01 to about 0.15, or more. For some embodiments, the web engaging assembly **70** includes a distance between the first blade and the second blade of between about 0.03 and 0.07 inches, and most preferably about 0.05 inches. Furthermore, in at least one embodiment of the invention each of the four web engaging assemblies **70** on a bedroll are identical to each other. In this way, it is possible to provide one blade system or type that can be used as a common spare for all continuous winders of the stated design, reducing inventory requirements for such parts.

When the bedroll **17** is rotated such that the web engaging assembly **70** is at the three o'clock position (i.e., three o'clock position as on a clock face), the pin assembly **65** may be mounted to the clamps **71** (using threaded connector **72**) in a horizontal direction (i.e.: as along arrow **59** in Figure **5**). Thus, in that way it is possible to provide maintenance and replacement of the mounting hardware which is accessible without removing bedroll covers (not shown). Removal of a

unitary elongated mandrel **65** typically requires removal of a center bedroll cover (not shown).

In the general application of the invention, a web engaging assembly may include a web engaging member, such as unitary elongated mandrel **65** (as one example), in which the pin assembly **60** may be moved between a first position (in which the pin assembly **60** is inward of the outer surface of the winding roll) and a second position in which the pin assembly **60** projects beyond the outer surface of the bedroll **17**, and is engaged with the web **23**. The pin assembly **60** may act to carry the web in the cutting and winding process.

It should be understood that the invention is not limited to any particular bedroll configuration. For example, the invention could be employed with conventional latch mechanisms in which a center rewinder is used to retain the severing and transferring mechanism in an inoperative position until the proper length of web has been wound onto the log. In such systems, a latch mechanism with a severing and transfer mechanism could be used which employs pins, cut-off blades, and transfer pads, all of which are movably mounted within the bedroll. In some applications, the invention could be used in those configurations in which a transfer mechanism is unlatched, and pins hold the web against a rotating bedroll while the web is severed by a chopper roll. In such applications, the transfer pads could thereafter urge the leading end of the severed web against a new core. Thus, the embodiment shown in

Figure **2**, which employs push rods **38a-d**, is only one illustrative configuration of a bedroll which could employ the invention. Some applications may use a solenoid to position a cam follower to release the latch mechanism. There are many such possibilities, and the invention is not limited to any particular configuration.

It should be recognized that the invention is not limited to only center rewinders, but may be employed with essentially any type of winding device made by any manufacturer that employs cut-off using a plurality of pins for engaging a sheet. It is understood by one of ordinary skill in the art that the present discussion is a description of exemplary embodiments only, and is not intended as limiting the broader aspects of the present invention, which broader aspects are embodied in the exemplary constructions. The invention is shown by example in the appended claims.